



Patent Application of

Jiaduo Wang

for

**TITLE: A MESHED (POROUS) STEEL PIPE/TUBE  
USED AS CONCRETE REINFORCEMENT**

**FIELD OF THE INVENTION**

This invention relates to concrete reinforcement, such as used in bridges, buildings and other concrete structures which its reinforcement is use longitudinal and transverse steel reinforce bar wired together, it may substituted by the meshed (porous) steel pipe/tube.

## BACKGROUND OF THE INVENTION

Over the years, people using longitudinal and transverse steel reinforce bar wire together as steel cage to be concrete reinforcement. This provides good resistance on longitudinal compression (tension) force, transverse shear force and torsion shear force. However, to do this need at least 3 steps of work: a: cut and bent reinforce bar, b: wire reinforce bar together as steel cage, and c: install the steel cage to where the reinforcement is needed. All these three steps of work need many labor and time.

ACI 10.9.1 says: "Area of longitudinal reinforcement for noncomposite compression member shall be not less than 0.01 nor more than 0.08 times gross area of section." This large steel to gross area of section ratio made it is possible to use meshed (porous) steel pipe/tube as concrete reinforcement instead the use of the traditional longitudinal and transverse reinforce bar wire together. Since the meshed (porous) steel pipe/tube is buried in concrete it worked as well as traditional reinforcement. Even more, it has some more advantages:

- 1) The meshed (porous) steel pipe/tube can be factory fabricated and is easy to install, this resulting in significant time savings both on shop work and on site construction. It saves time and labor.
- 2) "The transverse reinforcement is needed to prevent the highly stress, slender longitudinal reinforce bars from buckling outward by bursting the thin concrete cover" (Nilson). Since the meshed (porous) steel pipe is one piece in both longitudinal and transverse direction, it has better function to prevent the longitudinal reinforcing buckling than traditional reinforcing in concrete member.

- 3) It is easy to put some more longitudinal/transverse reinforce bar into the meshed (porous) steel pipe/tube before the concrete being poured, to match the designed cross sectional ratio of steel reinforcement area to gross member area.
- 4) Since the meshed (porous) steel pipe/tube is one piece in both longitudinal and transverse direction, it has better function for shear resistance than traditional ties, so it has better function to resist earthquake.
- 5) When the column is being loaded, it shortens longitudinally and expands laterally, this cause hoop tension in meshed (porous) steel pipe/tube. The meshed (porous) steel pipe has good function to prevent concrete expansion laterally, while the carrying capacity of the confined concrete in the core is greatly increased.
- 6) Eventually, the size of the member and the cross sectional area of steel can be reduced, thus saving time and money.
- 7) Since the meshed (porous) steel pipe/tube is one piece in both longitudinal and transverse direction, the beam-to-column joint and beam-to-girder joint become possible to install like steel structure joint, thus saving time and money.
- 8) The splice of the meshed (porous) steel pipe/tube can be weld or bolt, it is much short than the traditional reinforce bar splice, thus saving time and money.
- 9) Since the meshed (porous) steel pipe/tube is buried in concrete, it has good fireproof function.

The Construction Procedure as follows:

- 1) The meshed (porous) steel pipe/tube can be made in a factory.
- 2) Ship the meshed (porous) pipe/tube to shop then to construction site and install it.

- 3) Providing formwork.
- 4) Pouring a mass of concrete into the meshed (porous) pipe/tube and vibrate it to make sure that the concrete fits into and there is no void between the meshed (porous) steel pipe/tube and formwork.
- 5) Stripping the formwork.

## DETAILED DESCRIPTION OF THE INVENTION

In FIG. 1, a meshed (porous) steel pipe/tube 1 which has many holes 2 on its wall can be used as concrete reinforcement. A mass of concrete 3 is poured into the meshed (porous) steel pipe/tube 1 and through the holes 2 on its wall filled into the place between steel pipe and formwork and form the composite meshed (porous) steel pipe/concrete member. The meshed (porous) steel pipe 1 is buried in concrete 3 it works as well as traditional reinforcement, even more, it have some more advantage: easy to ship/install, increase the concrete carrying capacity, reduce the concrete member size, significantly time and labor saving, and good fire proof function.

In FIG. 2, It is easy to put some more longitudinal/transverse reinforce bar 4 into the meshed (porous) steel pipe/tube 1 before the concrete 3 being poured, to match the designed cross sectional ratio of steel reinforcement area to gross member area.

In FIG. 3, the splice 5 of the meshed (porous) steel pipe/tube 1 can be weld or bolt, it is much short than the traditional steel reinforce bar splice.

In FIG 4, the meshed (porous) steel pipe/tube 1 is one piece in both longitudinal and transverse direction, the beam 6-to-column joint and beam 6-to-girder joint become possible to install like steel structure joint.